Emergency and Disaster Response to Chemical Releases

Technician Level Training

29 CFR 1910.120 (q)

Module 7

Site Control

This page left blank intentionally.

Table of Contents

This page left blank intentionally.

Acronyms Used in This Module

ACGIH	American Conference of Governmental Industrial Hygienists
CAA	Clean Air Act
CBRNE	Chemical, Biological, Radiological, Nuclear, Energetic/Explosive
CERCLA	Comprehensive Environmental Response Compensations Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
DNR	Department of Natural Resources
DOT	Department of Transportation
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICS	Incident Command System
IDLH	Immediately Dangerous to Life and Health
NCP	National Contingency Plan
NIOSH	National Institute of Occupational Safety and Health
NRC	National Response Center
OSHA	Occupational Safety and Health Administration
PAZ	Protective Action Zone
PAD	Protective Action Distance
PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
RCRA	Resource Conservation Recovery Act
RQ	Reportable Quantity
SARA	Superfund Amendments and Reauthorization Act
SCBA	Self Contained Breathing Apparatus
SOP	Standard Operating Procedures
TSCA	Toxic Substance Control Act
TICs	Toxic Industrial Chemicals
TIMs	Toxic Industrial Materials
WMD	Weapons of Mass Destruction

This page left blank intentionally.

Overview

Site control is a key element in controlling the risk from hazards presented at a chemical spill or release. Before beginning containment, confinement, or control actions, a site management program must be initiated. This site management program most commonly divides the area into three zones: the Exclusion Zone, the Contamination Reduction Zone, and the Support Zone. After the zones have been established, clearly defined and marked, trained responders utilizing the proper PPE will be allowed to enter into the Exclusion Zone and work to contain and control a spill.

Terminal Learning Objective

Upon completion of this module, participants will demonstrate the ability to establish site control procedures for a disaster site or emergency response to a release of hazardous materials.

Enabling Objectives

Based on the information presented in the classroom and in the participant guide, participants will be able to:

- Explain why site control zones are established at every incident.
- Explain the function of the Exclusion Zone, the Contamination Reduction Zone, and the Support Zone.
- Describe methods for establishing the boundaries of the Exclusion Zone.
- Discuss the importance of establishing an alternative route of egress out of the Exclusion Zone in case of an emergency situation.
- Identify methods that ensure contaminants are not spread.

This page left blank intentionally.

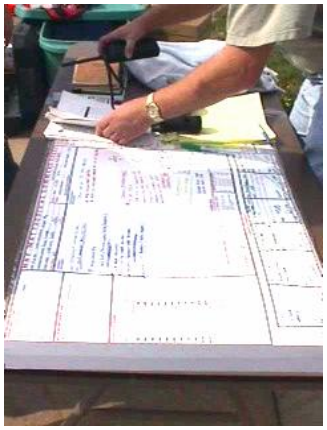
Introduction

Initially, site control is established to control a geographic area with the goal of preventing unauthorized entry into the contaminated area. Effective site control prevents untrained and unprotected individuals from harm and minimizes the spread of contaminants. If the first-arriving responder fails to use all available information to exercise adequate protective actions, then lives, property, and incident control may be lost.

Site control is accomplished by establishing physical barriers or posting guards around the area to alert others and prevent unauthorized entry. As the incident progresses, ongoing site control prevents unauthorized access to all areas in which responders are performing containment and control operations. Effective site control prevents bystanders and sightseers from interfering with ongoing hazardous materials operations.

Before moving to establish site control, responders must obtain as much information as possible regarding the nature of the call. If responders respond without being fully informed, they may become victims themselves. It is imperative that responders collect as much information as possible before trying to establish the Exclusion Zone hot line.

Pre-Incident Planning



The collection of information regarding a potential hazardous materials release should begin during pre-incident planning. Pre-incident planning is the collection of information regarding potential releases and their likely impact on people (on and off site), the environment, and the facility. The availability of pre-incident planning information, in addition to that which is received when an emergency is actually reported, can make a significant difference in the outcome of the incident.

Initial Responder Responsibilities

The initial responder's responsibilities also include the following procedures:

- Take command.
- Secure the area and prevent anyone from entering.

- Survey the incident from a safe distance to confirm the identity of the materials involved.
- Determine the appropriate actions to be taken as recommended by the emergency response plan or the emergency response guidebook.
- Notify supervisors.
- Notify off-duty responders.
- Notify mutual aid agencies.
- Activate prescribed departmental procedures (i.e., remote shut-down procedures).

While establishing the Exclusion Zone, no action should be taken that would place the responders or others in a position of danger or in contact with the material.

Initial On-Scene Incident Commander

The initial on-scene Incident Commander (IC) should obtain the MSDS for the chemical as soon as possible. The MSDS must list the name, address, and telephone number of the chemical manufacturer or importer. If necessary, the IC can contact the chemical manufacturer for additional response information.

To identify the boundaries of the Exclusion Zone, the responder must analyze the incident to determine the extent of the problem. Once the problem is identified, he or she must predict possible outcomes. The first-arriving responder accomplishes these tasks by performing the following functions:

- Survey the condition of containers.
- Identify the nature and extent of the release.
- Gather and share information with all involved parties.
- Predicting the incident's future course.
- Estimating likely harm to responders, the public, and the environment.

Gathering Information

When a spill is reported, responders must be trained to obtain as much information as possible regarding the incident. He/she should ask questions that will help determine whether a hazardous material may be involved and, if so, what the material is.

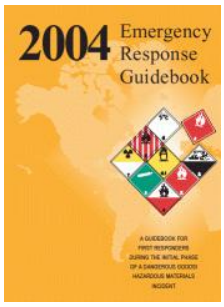
It may be helpful to have a prepared list of questions to ask the caller. This list of questions will help determine the nature of the incident.

If possible, the following information should be gathered:

- Location of the incident
- Identity of the hazardous material involved (spelled out if possible)
- Approximate quantity of the material spilled
- Type of container
- Condition of the container
- Number and proximity of persons threatened
- Brief description of the events leading to the incident
- Summary of control actions taken or underway
- Type of assistance needed
- Primary and alternate access points
- Prevailing weather conditions at the scene
- Name and location of the caller reporting the incident
- Arrangements for re-contacting the reporting party

Using the emergency response plan and the information gathered from witnesses, the initial responders formulate a plan for approaching the spill to delineate boundaries and establish site control. The emergency response team always must be prepared to change the response whenever additional information warrants such a change.

The North American ERG



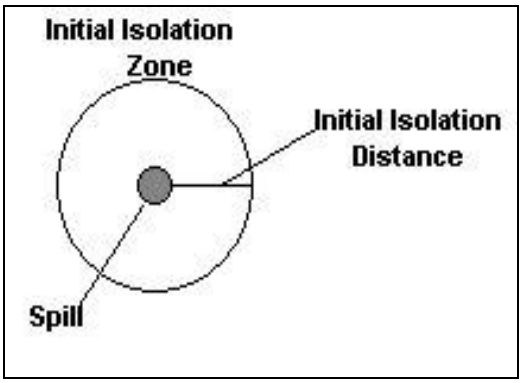
The U.S. Department of Transportation's North American Emergency Response Guidebook (ERG) may be used as an aid in establishing the initial Exclusion Zone. The ERG provides responders with recommended evacuation distances for chemicals that can be identified by:

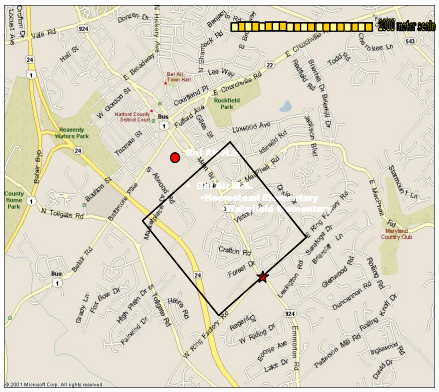
- Proper DOT shipping names.
- United Nations Identification Numbers.
- Vehicle or bulk-container placards.
- Non-bulk package labels.

Responders can use the isolation distance recommended in the orange-bordered guides or the initial isolation and protective action distances found in the green-bordered pages of the guidebook as an aid in establishing the Exclusion Zone boundaries.

The Initial Isolation Zone

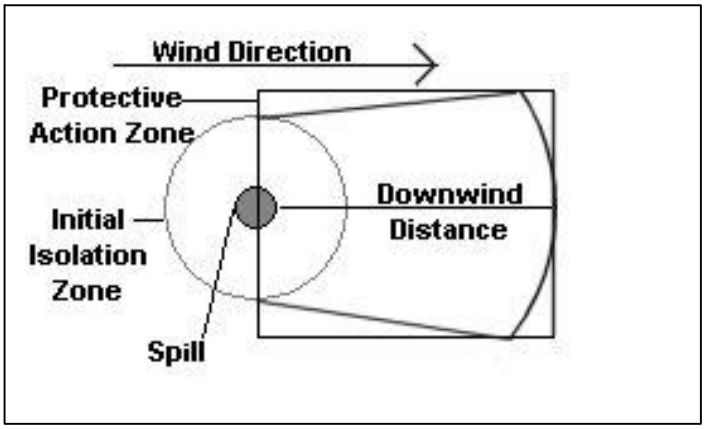
The Initial Isolation Zone defines an area surrounding the incident in which persons may be exposed to dangerous concentrations of material and directs persons to move, in a crosswind direction, away from the spill to the distance specified in the ERG. Recommended isolation distances can be found in the orange- or green-bordered pages.





The Protective Action Zone

The Protective Action Zone defines an area downwind from the incident in which persons may become incapacitated and unable to take protection and/or incur serious or irreversible health effects. Protective action distances are found in the green-bordered pages of the ERG. The table of protective action distances provides specific guidance for small and large spills occurring day or night.



Factors That Change the Protective Action Distances (PAD)

If a material becomes involved in a fire, the explosion hazard may become the primary factor in determining the isolation distance. In this situation, the orange-bordered guides indicate the isolation distance for an explosion hazard.

The following conditions may necessitate the protective action distance to be increased beyond the distance recommended by the Emergency Response Guidebook:

1. Multiple tank cars, cargo tanks, portable tanks, large cylinders or fixed bulk tanks are involved in the incident.
2. Toxic vapors channeled into valleys or between tall buildings, causing the airborne plume to remain concentrated due to less mixing of the plume with the atmosphere.
3. Daytime spills in regions with known atmospheric inversions.
4. Spills over cold or snow-covered ground accompanied by a slow steady wind.

When these conditions are present, airborne contaminants mix and disperse slowly and toxic concentrations may travel great distances downwind.

Site Control Zones

Control zones are necessary to provide the rigid scene control required at a hazardous-materials incident. The zones prevent unauthorized persons from interfering with emergency responders, help to regulate the movement of personnel within the established zones, and minimize the spread of contaminants. Control zones are not static! The zones can be expanded or contracted as necessary. Generally, three control zones are established at a hazardous materials incident. These zones are frequently called:

- The Exclusion Zone
- The Contamination Reduction Zone (CRZ)
- The Support Zone

The Exclusion Zone

The Exclusion Zone is established as a geographic area surrounding the incident. This zone always includes the area that has actually been contaminated by the released material. The Exclusion Zone should also incorporate a buffer for potential escalation of the incident. The Exclusion Zone must extend far enough to prevent people from suffering ill effects from the released material.

Only authorized personnel may work in the Exclusion Zone because of the potential exposure to gases, vapors, mists, dusts, or liquids. Persons authorized to work within the Exclusion Zone include hazardous-materials technicians, hazardous-materials specialists, and skilled support personnel. All personnel entering the Exclusion Zone must use the buddy system. Any time the entry team is working in the Exclusion Zone, a backup team must be standing by in the Support Zone. Regulations require back-up personnel to stand by in the Support Zone with equipment ready to provide assistance or rescue.

Establishing the Exclusion Zone

The Exclusion Zone must be established immediately upon arrival of the first trained responder. It is the responsibility of the first responding hazardous-materials technician to take command of the incident to ensure the safety of employees and the public and to facilitate rapid control of the incident.

Some organizations refer to the Exclusion Zone by one of the following descriptions:

- Restricted Zone
- Hot Zone
- Red Zone
- Work Zone

Contamination Reduction Zone

The Contamination Reduction Zone (CRZ) is an area abutting the Exclusion Zone and extending to the Support Zone. The primary purpose of establishing the CRZ is to control access into and out of the Exclusion Zone. The decontamination corridor is established with in the boundaries of the CRZ. The decontamination corridor is always the primary route of egress for personnel who have entered into the Exclusion Zone. The decontamination corridor is used to remove contaminants form personnel and equipment moving from the Exclusion Zone to the Support Zone. Those entering the CRZ must wear appropriate PPE and must also be decontaminated before returning to the Support Zone.

The Contamination Reduction Zone (CRZ) is designed to reduce the probability of contamination in the clean Support Zone. As one moves from the hot line to the Support Zone, the degree of contamination decreases.

The CRZ must be designed to facilitate:

- Decontamination of equipment, personnel, and samples.
- Emergency response (e.g., transport for injured personnel, use of first-aid equipment, and use of containment equipment such as fire extinguishers).
- Equipment re-supply (e.g., air tanks, personal protective equipment/ clothing, and sampling equipment and tools).
- Sample packaging for on-site and off-site laboratories.
- Drainage and containment of water and other liquids used during decontamination.
- A worker temporary rest area, including benches and shade.

Emergency response personnel are not required to wear protective equipment to set-up the decontamination line because the decontamination corridor is always established in an uncontaminated area. Once the decontamination line is set up, only adequately protected decontamination workers and entrants are allowed in the CRZ. Personnel within the CRZ should be required to maintain internal communications, line-of-sight contact with work parties, work party monitoring, and site security.

Other terms for the Contamination Reduction Zone include the following names:

- Warm Zone
- Limited Access Zone
- Yellow Zone

Support Zone

The Support Zone is located directly outside of the Contamination Reduction Zone. Responders establish this zone to allow support operations to be performed without interference by sightseers or bystanders. Support operations should be conducted in a location that is uphill and upwind of the incident.

The only persons allowed into the Support Zone are those who are responding to the incident. Bystanders and sightseers should not be allowed to enter the Support Zone until the Incident Commander terminates the incident.

Workers in the Support Zone are not required to wear personal protective clothing because the Support Zone is established in an area that is free of contaminants. However, the Site Safety Officer may require periodic air monitoring to assess the spread of contaminants. The Site Safety Officer may also require personnel in the Support Zone to wear chemical dosimetry devices (i.e., chemical dosimetry badges or passive detector

tubes) to ensure that unprotected support personnel are not exposed to hazardous chemicals above occupational exposure limits.

Many support operations are located within the Support Zone including:

- The command post.
- Safety.
- Logistical support.
- Staging.
- Dressout.
- Medical support.
- Security.

When locating these facilities within the Support Zone, the following factors should be considered:

Accessibility	Topography, open space available, locations of highways and railroad tracks, ease of access for emergency vehicles.
Resources	Adequate roads, power lines, telephones, shelter, and water.
Visibility	Line-of-sight to all activities in the Exclusion Zone.
Wind Direction	Upwind of the Exclusion Zone, if possible.
Distance	As far from the Exclusion Zone as practical.

Other names for the Support Zone include the following terms:

- Cold Zone
- Green Zone

Using Monitoring Equipment to Establish Boundaries

Fixed or portable monitoring instruments may be used to establish the boundaries of contamination. The boundary of the exclusion should be set at a point where air monitoring instrumentation indicates that atmospheric contaminant levels are below the permissible exposure limit (PEL) for the chemical. Fixed monitoring equipment is often positioned around the perimeter of a facility to monitor the escape of industrial chemicals. These are fine instruments, capable of measuring

contaminants on a single-digit parts-per-million (ppm) scale. Fixed instrumentation can provide valuable information about airborne contamination levels without risk because of their ability to monitor remotely and pass information to a control room.

Portable air-monitoring instruments may also be used to establish the boundaries of airborne contamination. Toxic gas sensors measure specific gases or vapors on a ppm or parts-per-billion (ppb) scale. These portable instruments can also provide valuable information about levels of airborne contaminants.

Caution! Combustible Gas Indicators (CGIs) should not be used to establish site boundaries. These instruments measure on a %LEL scale rather than on a ppm scale. The lowest range of detection of a CGI is from 100 to 1000 ppm. Many flammables are toxic below these levels. A CGI should not be used to establish site boundaries but may be carried to prevent responders from entering into a dangerously flammable atmosphere**.**

Colorimetric detector tubes can be used to determine the presence of airborne contamination. These tools can provide information about the presence of airborne contaminants on a ppm scale. However, caution is warranted in the use of colorimetric tubes during emergency response.

For accurate results, the directions that come with the tubes must be followed exactly. Corrections must be made for temperature, humidity and barometric pressure. The presence of other gases in the atmosphere may inhibit or enhance the chemical reaction in the tube. Because of these limitations, the use of colorimetric tubes during an emergency response is often limited to detection of the presence of airborne contaminants.

Standard Operating Procedures

Every organization that expects employees to respond to a hazardous materials emergency must develop an emergency response plan. Responders are required to operate under the expectations lain out within the emergency response plan. Copies of the plan must be made available to all responders and should be reviewed periodically.

Standard operating procedures (SOPs) are contained within the emergency response plan. SOPs must address all phases of an emergency response and should provide guidance in establishing site control. The task of establishing the Exclusion Zone is most easily accomplished when standardized operating procedures (SOP) are used to assess risk and determine the best course of action.

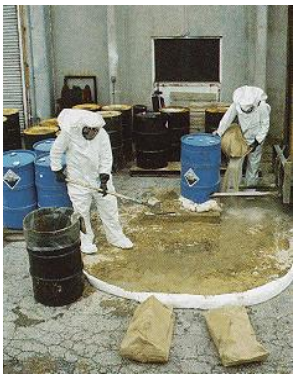
Standard Operating Procedures must address:

- The identity of hazardous materials within the facility.
- Safe distances and places of refuge.
- Methods to warn employees at risk.
- Methods to account for employees in the event of an evacuation.
- Methods to warn people (the public) at risk.

Physical Properties of the Material and Site Control

Outdoors, site control is a factor of the physical properties of the hazardous material, weather, and geography. All unprotected personnel must remain up-wind, up-stream and up-hill from the spill. The Safety Officer must continuously monitor weather conditions to ensure that support personnel do not become exposed to contaminants if conditions change suddenly.

Solids and powders usually do not flow unless there is some medium to move them. A stationary spill of a solid material may require no more than cordoning-off of the immediate area and sufficient buffer to set up decontamination and support zones. Solids and powders may be soluble, insoluble, or water reactive. Rainy conditions may cause solids and powders to run off, off-gas toxic vapors to explode and burn. Windy conditions may cause solids and powders to become airborne and affect nearby populations. Weather conditions must be evaluated carefully when establishing the boundaries of the Exclusion Zone.



Liquids and solids-in-water will flow and establishing site control can be difficult when materials flow into sewers, and waterways. A large spill may contaminate a rapidly expanding geographic area. Anyone performing site control must anticipate areas that may be affected by flowing materials. If possible, resources should be used to stop the flow with defensive actions: block drains, sewers and waterways ahead of the flowing material.

Spills that involve airborne contaminants require individuals performing site control to evaluate the situation to determine if adjacent populations might be affected. Large geographic areas may be

affected if airborne contaminants are released. The person in command, in association with local emergency management agency representatives, must then determine if those affected populations must be evacuated or sheltered in place.

Other Considerations

In-Place Sheltering

The decision whether to shelter in-place or evacuate can be made only after assessing all relevant factors and determining which action will provide the public with the greatest degree of protection. If the incident involves a short-term airborne release, in-place sheltering may be the preferred option. If the incident appears to be a long-term event, evacuation may be the preferred action.

The Incident Commander must determine, from information available and after conferring with local health and emergency management agency (EMA) officials, on the type of protection necessary for the general public. In-place sheltering may be the only viable alternative if an entire area is cloaked in a toxic vapor cloud. Some of the variables that must be taken into account are the type and quantity of the material involved, current and forecasted weather conditions, location of the incident, and movement of any toxic vapor plume from the site of the incident.

Because of these variables, a general evacuation of citizens may not be necessary or prudent. It may be advisable to keep citizens inside with doors and windows closed and air circulation equipment, such as furnaces and air conditioners, shut off both in private homes and institutional settings.

Notice to the public should be initiated as soon as possible. Using plans developed by the local emergency management agency, the notice can be broadcast on the Emergency Broadcast System and should be augmented by the use of Emergency Management sirens and public address systems.

Evacuation

When evaluating the need for evacuation, the Incident Commander and local EMA officials must consider the time of day and method of public notification, the time required to evacuate the affected area, and the resources needed to accomplish the evacuation. Another factor that must be considered is the potential for exposure to the product of both

the evacuees and the personnel responsible for evacuating the area. If the chance for dangerous contamination exists, the IC should consider other options.

Evacuation can be accomplished using the emergency broadcast system and public address systems on emergency vehicles. To confirm that the public has been successfully evacuated, door to door notification may also be necessary. Law enforcement officers, who will then have the duty of sealing off the affected area, should conduct any general evacuation.

Releases Inside Buildings

One of the most important responsibilities of the first arriving responders is to close off all access to the release area. This task must be undertaken at the earliest possible moment. Personnel should be assigned to control all entry points; this is important indoors as well as outdoors.

Releases inside a building may require the entire building to be evacuated and become the Exclusion Zone. Other buildings may be of such construction that a spill in one part of the building can be isolated to that particular area. Always evacuate the entire building unless the emergency response plan indicates that a building may be divided into zones.

Indoors, many areas have multiple entry points. Isolation and control of the hazardous area may require many response personnel. Whenever possible, the IC should assign personnel to monitor every access point to prevent unauthorized entry. When access points cannot be physically guarded, doors should be locked and notice should be posted for the hazards contained within. Whatever the method, control must be established and maintained over all routes of access throughout the incident.

Safe Havens and Alternative Routes of Egress

Before entry begins, the entry team, the backup team and decontamination personnel must be briefed on emergency procedures. If an emergency arises and the entry team cannot exit through the decontamination corridor as planned, they must move to a “safe haven” and wait for an alternative route of egress to be established.

The safe haven is a location within the Exclusion Zone where entrants can wait for the decontamination corridor to be reestablished in case of an emergency. The alternative route of egress is a secondary decontamination corridor that is established if the primary decontamination line cannot be used.

A portable decontamination setup may be an asset in this situation. If stationary safety showers are used for decontamination, primary and

secondary showers must be designated. If a single safety shower is used, a portable decontamination line may be maintained as a backup.

Alternative Means of Communications

The emergency response plan should establish a secondary means of communication for warning entrants to evacuate if the primary communication system fails. This method of alternative communication should be established as a standard operating procedure within the emergency response plan. Secondary means of communications may include air-horns, sirens, whistles, and public-address systems.

Medical Support

During an emergency response, advanced first aid support personnel, as a minimum, must stand by with medical equipment and transportation capability. The medical support team operates exclusively within the Support Zone. Initially, the medical support team is used to assess the entry team's vital signs. Vital signs are taken to establish a baseline profile for team members that are required to wear personal protective equipment. Medical support personnel remain available throughout the incident in case of a medical emergency.

If workers or responders are contaminated, they are brought through the decontamination process and only then into the triage/treatment area. The medical support team provides medical assessment (triage) and stabilization (treatment) in the Support Zone after the victim has been decontaminated.

To provide protection for the medical support team, victims requiring immediate care are grossly decontaminated and wrapped before treatment is provided. Victims requiring other medical treatment are thoroughly decontaminated and only then receive treatment.

Summary

Control zones are necessary to provide the rigid scene control required at a hazardous-materials incident. The zones prevent unauthorized persons from interfering with emergency responders. Generally, three control zones are established at a hazardous materials incident. These zones are frequently called:

- The Exclusion Zone,
- The Contamination Reduction Zone (CRZ), and
- The Support Zone.

During the incident, the CRZ should be closely examined and monitored for the spread of contaminants. By closely monitoring contaminant levels, the officials in charge can ensure the quality of the decontamination process.

Security personnel must be strategically deployed to ensure site security. Security personnel must control the perimeter and operate an access control point into the Support Zone. By maintaining a log of all personnel entering the Support Zone, the Site Safety Officer can ensure personnel accountability in case of an emergency evacuation.

Review Questions

1. Explain why access to the Exclusion Zone is limited.

2. What purpose does the CRZ serve?

3. List the initial actions that are employed in site control at a spill or release.

4. Why does the first arriving responder assume the role of initial Incident Commander?

This page left blank intentionally.